Mars Network Operations Concept

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Abstract

NASA's Mars Surveyor Program is developing plans for an evolving constellation of satellites in Mars orbit, called the Mars Network, to support the telecommunication and navigation needs of future Mars exploration. Serving as an extension of the Deep Space Network, this Mars-orbiting network must support a diverse set of users, including planned missions, as well as yet-to-be defined mission concepts. Network elements, as currently envisioned, comprise low-cost microsatellites, carried as piggyback payloads on commercial launches, as well as Mars Areostationary Relay Satellites (MARSAT) to support the more ambitious needs of robotic outposts. Goals of the Mars Network include: increasing the overall data return from the Mars surface to Earth; increasing the frequency of contact between the Mars surface and Earth; providing efficient relay communications for small, energy-limited surface elements, and; supporting high-accuracy navigation scenarios such as precision landing, long-range surface navigation, and in-orbit rendezvous.

Mars Network operations must provide an efficient, and largely autonomous, switching mechanism to coordinate the demands of the burgeoning number of user assets expected at the planet. In addition, operations of the network assets themselves must also be done in as efficient and autonomous a manner as possible. The operations concept covers the topology of the network spanning the diverse number of switched links among the Mars surface, Mars orbit, Mars approach trajectory, Earth and inter-network cross-links. Evolution of this topology, due to planned enhancements and unplanned anomalies will be discussed. Other operational issues, such as load management, advance vs. real-time scheduling, prioritization and levels of service, handoffs and multiple satellites in view will be discussed. Finally, an overview of applicable protocols will be provided.